

# Implantation of Artisan toric phakic intraocular lens following Intacs in a patient with keratoconus

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We report a 24-year-old man with bilateral keratoconus in whom Intacs (Addition Technology, Inc.) were implanted in both eyes. The procedure was followed by Artisan toric phakic intraocular lens (Ophtec) implantation to correct the residual myopic and astigmatic refractive error.

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Keratoconus is a progressive, noninflammatory, bilateral corneal dystrophy characterized by paracentral cone-like steepening of the cornea and corneal ectasia. The progressive thinning and subsequent anterior bulging of the cornea can lead to severe astigmatism and central scarring.<sup>1</sup>

Various surgical procedures including photorefractive keratectomy, epikeratophakia, sectorial keratotomy, and lamellar keratoplasty have been suggested as alternatives to penetrating keratoplasty for the treatment of keratoconus, but they have had disappointing results.<sup>2</sup> Intacs segments (Addition Technology, Inc.), first used in keratoconus eyes in 2000 by Colin et al.,<sup>3</sup> are now widely used in keratoconus patients. The goal is to postpone the need for a corneal transplant and restore contact lens tolerance. Intacs provide structural integrity and support to the central optical zone, and reports show a decrease in the manifest refraction spherical equivalent.<sup>4</sup> However, even after Intacs implantation, high refractive errors may remain and cause patient dissatisfaction. For visual rehabilitation, spectacles can be prescribed or soft contact lenses can be tried over the Intacs segments.<sup>5</sup>

Artisan phakic intraocular lenses (pIOLs) have been implanted safely and effectively to treat high ametropia. In 1989, Fechner et al.<sup>6</sup> modified the existing

iris-claw IOL for aphakia into a negatively biconcave lens to correct myopia. To increase its safety, the optic design was changed to a concave–convex shape.<sup>7</sup> Artisan toric pIOLs have been introduced with both spherical and cylindrical corrections and have been implanted with satisfactory results.<sup>8</sup> We report a patient with bilateral keratoconus who had Intacs and Artisan toric pIOL implantation in both eyes.

## CASE REPORT

A 24-year-old man who had been using rigid gas-permeable contact lenses in both eyes for 2 years but had been unable to use them for 2 months presented with bilateral keratoconus. In the right eye, the uncorrected visual acuity (UCVA) was counting fingers at 3 m and the best corrected visual acuity (BCVA) was 0.4 with  $-10.00 -5.50 \times 35$ . In the left eye, the UCVA was CF at 2 m and the BCVA, 0.2 with  $-9.00 -5.50 \times 135$ .

Intacs were implanted in both eyes, with the thinner segment (0.25 mm) placed superiorly and the thicker segment (0.45 mm) placed inferiorly based according to the spherical equivalent of the refractive error based on the nomogram recommended by Colin et al.<sup>4</sup> Sixteen months after Intacs implantation, the UCVA was 0.2 and the BCVA, 0.6 with  $-6.50 -4.50 \times 35$  in the right eye and 0.1 and 0.3 with  $-6.50 -5.00 \times 150$ , respectively, in the left eye. Spectacles were prescribed, but the patient was not satisfied with them and was unable to tolerate soft contact lenses. The preoperative and postoperative corneal topographies (Pentacam, Oculus Opticgeräte GmbH) are shown in [Figure 1](#).

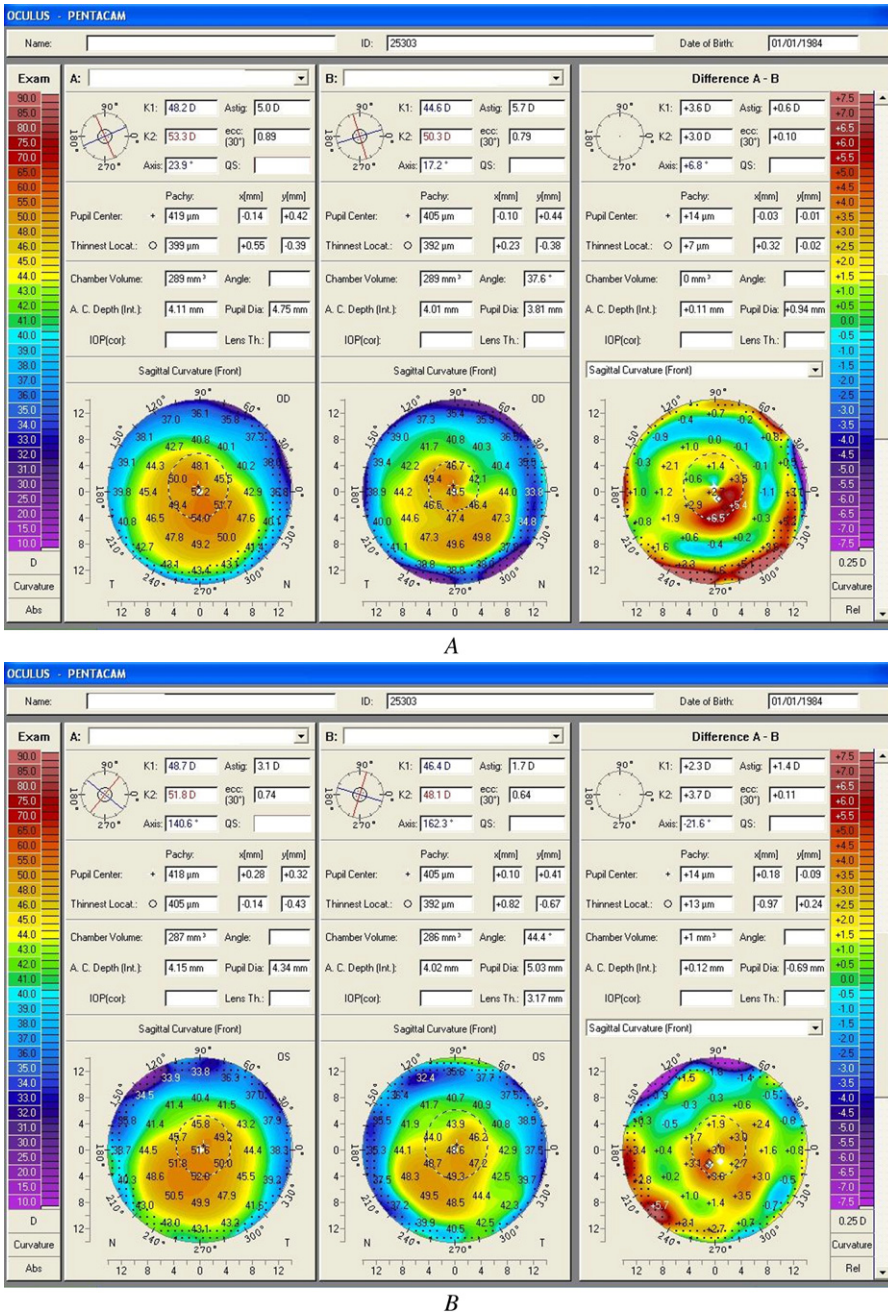
The endothelial cell count was 3240 cells/mm<sup>2</sup> in the right eye and 2995 cells/mm<sup>2</sup> in the left eye. Anterior chamber depth was 4.11 mm and 4.15 mm,

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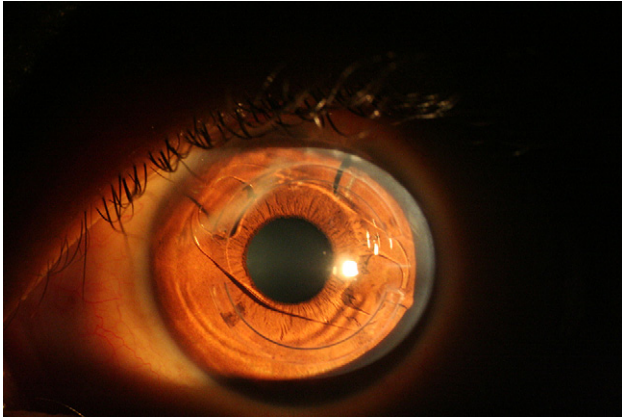


**Figure 1.** A: Preoperative (left) and postoperative (middle) sagittal curvature map of the right eye; differential sagittal map comparing before and after Intacs implantation (right) shows the decrease in keratometric values and astigmatism. B: Preoperative (left) and postoperative (middle) sagittal curvature map of the left eye; differential sagittal map comparing before and after Intacs implantation (right) shows the decrease in keratometric values and astigmatism.

respectively. There was no ocular pathology other than keratoconus, so Artisan toric pIOL implantation was planned.

Surgery was performed under retrobulbar anesthesia in both eyes on successive days. A 5.5 mm corneal incision site was marked between the 10 o'clock and 2 o'clock positions, and 2 paracentesis sites were placed at the 8 o'clock and 4 o'clock positions. After acetylcholine was injected to constrict the pupil, the anterior chamber was filled with sodium hyaluronate and a corneal incision was made with a 45-degree diamond knife at the previously marked site. Artisan toric pIOLs with a power of  $-8.00 -5.00 \times 0$  in the right

eye and  $-8.00 -5.50 \times 0$  in the left eye were inserted with a forceps into the anterior chamber. They were centered on the pupil with a 35-degree axis in the right eye and a 155-degree axis in the left eye. At the same time, an enclavation needle was inserted through the paracentesis and was introduced through the pupil under the iris to lift a 1.0 mm iris fold and enlave it on the claw of the temporal haptic. Enclavation was then done on the nasal haptic. A peripheral iridotomy was performed at 11 o'clock in the right eye and at 1 o'clock in the left eye. The corneal incision was closed with 3 interrupted 10-0 nylon sutures, and the sodium hyaluronate was aspirated.



**Figure 2.** Anterior segment photograph showing Intacs and Artisan pIOL in the left eye.

The sutures were removed after 3 months. At 5 months, the UCVA was 0.6 and the BCVA, 0.7 with  $-0.50 -1.50 \times 80$  in the right eye; the UCVA was 0.5 and the BCVA, 0.7 with  $-1.50 -0.50 \times 40$  in the left eye. The endothelial cell count was 3150 cells/mm<sup>2</sup> in the right eye and 2905 cells/mm<sup>2</sup> in the left eye. An anterior segment photograph of the left eye is shown in [Figure 2](#).

## DISCUSSION

In keratoconus patients with contact lens intolerance and clear central corneas, Intacs segments have been shown to improve objective visual outcomes and decrease the manifest refraction.<sup>4</sup> Asymmetrical ring implantation is considered in eyes with asymmetrical corneas. Nevertheless, with high ametropia, these precautions may not be sufficient to satisfy the patient if the residual manifest refraction does not enable him or her to wear spectacles or tolerate contact lenses.

Soft contact lenses can be tried over Intacs segments, and successful results are reported.<sup>5</sup> However, some patients cannot tolerate them or are unwilling to wear them. In these cases, surgical options can be considered.

Artisan toric phakic IOLs have been implanted in keratoconus patients with clear central corneas for the correction of astigmatism and spherical errors.<sup>9</sup> But since keratoconus is a progressive disease with changes in the shape of the cornea and thus the refraction over time, efforts should be made to stabilize the cornea before pIOL implantation.<sup>1,4</sup> An anterior

chamber pIOL was inserted after Intacs implantation in a patient with keratoconus by Colin and Velou.<sup>10</sup> The refractive results were satisfactory, with minimum residual myopia and astigmatism, and were stable for over 5 months. The manifest refractions in both eyes of our patient are similar to those in Colin and Velou's patient. In both cases, the BCVA as well as the UCVA improved, probably because of the decrease in visual distortion caused by preoperative high myopia and astigmatism.

Phakic IOLs can be considered in patients with residual high ametropia after Intacs implantation. Toric pIOLs may be preferred in eyes with high astigmatic refractive errors, as in our patient. Controlled randomized studies with longer follow-ups are needed to determine the type of pIOL to use and its safety, predictability, and stability.

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